

Natural Communities of Rhode Island



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and

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Among the first state-specific community classifications to be published and widely used in the northeast was Carol Reschke's first edition of Ecological Communities of New York State (Reschke 1990). This provided inspiration to all the northeastern Natural Heritage programs to create, expand and revise similar documents. Lesley Sneddon, Mark Anderson, Ken Metzler and Tom Rawinski contributed significantly to the development of regional and state classifications with the collaboration of state ecologists across the northeast. Frank Golet and the work of his many students added substantially to our understanding of wetlands in Rhode Island and the region.

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J. Lundgren 2006

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Introduction to the Natural Community Classification of Rhode Island

A **natural community** is an assemblage of organisms, their physical environment, the interactions among them, and the natural processes that affect them. Communities can be defined based primarily on plant species, geologic characteristics, animal assemblages, or other factors. This document defines natural communities primarily by dominant or characteristic plant species as they occur in assemblages repeated on the landscape. These are often tied to specific physical settings.

This document provides a consistent language for describing and naming the natural communities of Rhode Island in an easily accessible format that is useful to a variety of users: land trusts, land use planners, biologists, hikers, land owners, consultants and others. The classification is organized by **Systems**, which refer to complexes of natural communities that share the influence of similar hydrologic, geomorphologic, chemical, and biological factors. There are six systems in Rhode Island: **Marine, Estuarine, Riverine, Lacustrine, Palustrine, and Upland**. Systems are divided into Subsystems (e.g., Open vs. Forested) that aid in the identification or categorization of a particular community type.

The community types identified in each system and subsystem are distinguished by **physiognomy** (primary growth form of the vegetation), **species composition**, and **ecological processes**. The names assigned to each community type are descriptive labels and are not intended to describe all of the dominant species or the significant features. Communities may be named for a physiographic location (Maritime Beach Strand); the physiognomy of the vegetation (Dwarf Shrub Fen / Bog); or dominant species (Oak / Heath Forest). A diagnostic key is available to accompany the classification that will assist in identifying communities in the field.

The descriptions of each community type include **dominant species** (most abundant or greatest percent cover) and **characteristic species** (commonly found in community occurrences, although not necessarily abundant). An individual community example or occurrence (i.e., site) may not contain all of the species listed in the description. Moreover, the description includes only a very small portion of the total number of species present in that community type. Natural communities are inherently variable and it takes experience in the field to become familiar with the range of variability within types. In addition, natural communities are dynamic; changing in age, structure and composition over time and in response to natural disturbances such as flooding, wind storms, wildfire, disease outbreaks, etc.

The prevalence of **non-native species** in some locations can also add to the confusion in identifying a natural community occurrence. In general, one should rely on the physiognomy (structure) and native species composition to select the closest match. Sites dominated by non-native species are generally not included in this document (with a few exceptions such as *Phragmites* marsh) and the percentage of native versus non-native species is an important factor in identifying the best examples of a particular type. Sites with a higher percentage of non-native species are essentially poorer quality examples of a given community than sites strongly dominated by native species.

Descriptions may include information on important **environmental characteristics** (hydrology, substrate, topography, etc.) and **disturbance patterns** (e.g., periodic flooding, fire). In addition, for each community type a generalized distribution within Rhode Island, and a few examples of places to view them is included. Organizations such as the Rhode Island Natural History Survey (RINHS), Audubon Society of Rhode Island (ASRI), The Nature Conservancy (TNC), Rhode Island Wild Plant Society (RIWPS) and others can provide opportunities to see and learn about the state's natural communities. Contact information for these groups is included below.

Natural community classifications may follow different structures and formats, with advantages and disadvantages to each. The full hierarchy is not outlined in this document and this classification is not intended as a hierarchical and numerical mapping tool; however, this classification can be adopted or cross-referenced to other schemes. For example, it can be linked to other systems such as the U. S. Fish and Wildlife Service wetland classification (Cowardin, et al., 1979), or to regional and national classifications developed cooperatively by The Nature Conservancy, NatureServe and state Natural Heritage Programs (e.g., Anderson, et al., 1998). A cross-walk to the RI Natural Heritage mapping names is included in this document.

Plant taxonomy and nomenclature generally follows Gould et al. (1998), which is based on Gleason and Cronquist (1991), but some recent nomenclatural changes have also been adopted. Vertebrate animal taxonomy and names follow August et al. (2001).

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Reschke, C. 1990. Ecological Communities of New York State. New York Natural Heritage Program, New York State Department of Environmental Conservation. 96 pp.

SOURCES OF INFORMATION ON PLACES TO VISIT, FIELD TRIPS, SPECIAL PROGRAMS & OTHER RESOURCES IN RHODE ISLAND:

RI Department of Environmental Management
235 Promenade Street
Providence RI 02908
401-222-6800 general info
www.dem.ri.gov (see Planning and Development, Water Resources and Natural Resources Bureau)

Rhode Island Natural History Survey
Room 101, Coastal Institute in Kingston
1 Greenhouse Rd
University of Rhode Island
Kingston RI 02881
401-874-5800
www.rinhs.org

The Nature Conservancy
159 Waterman Street
Providence RI 02906
401-331-7110
www.nature.org/rhodeisland

Audubon Society of Rhode Island (Headquarters)
12 Sanderson Road
Smithfield RI 02917
401-949-5454
www.asri.com

Rhode Island Wild Plant Society
P.O. Box 2488
Providence RI 02906
401-453-3777
www.riwps.org

New England Wildflower Society
180 Hemenway Road
Framingham MA 01701
508-877-7630
www.newfs.org

TABLE OF CONTENTS

<i>I. Marine System</i>	9
A. Marine Subtidal	9
1. Marine Open Water _____	9
2. Marine Subtidal Aquatic Bed _____	9
B. Marine Intertidal	9
1. Marine Intertidal Mud Flat _____	9
2. Marine Intertidal Sand/Gravel Beach _____	10
3. Marine Intertidal Rocky Shore _____	10
<i>II. Estuarine System</i>	11
A. Estuarine Subtidal	11
1. Tidal River/Stream _____	11
2. Tidal Creek _____	11
3. Brackish Subtidal Aquatic Bed _____	11
4. Coastal Salt Pond _____	12
B. Estuarine Intertidal	12
1. Brackish Intertidal Flat _____	12
2. Brackish Marsh _____	12
3. Low Salt Marsh _____	13
4. High Salt Marsh _____	13
5. Salt Panne _____	13
6. Salt Shrub _____	14
<i>III. Riverine System (freshwater)</i>	15
A. Non-tidal River	15
1. Upper Perennial Stream/River _____	15
2. Lower Perennial Stream/River _____	15
3. Intermittent Stream _____	15
4. Blackwater Creek _____	16
B. Tidal River (freshwater reach; see Estuarine System for brackish reach)	16
1. Fresh Subtidal Aquatic Bed _____	16
2. Freshwater Tidal Marsh _____	16
<i>IV. Lacustrine System</i>	17
A. Mesotrophic Lake	17
B. Mesotrophic Pond	17
C. Coastal Plain Pond	17
D. Eutrophic Pond	18

V. Palustrine System 19

(note: substrate is used as an organizing feature rather than a clear taxonomic division. When in doubt, refer to all the wetlands that match the physiognomy (open types/ A & B or forested types/ C&D).

A. Open Wetlands (non-forested) on Mineral Soil.....19

- 1. Common Pond or Lake Shore (herbaceous community)19
- 2. Coastal Plain Pondshore19
 - a. Seasonally Flooded Coastal Plain Pondshore20
 - b. Semi-permanently Flooded Coastal Plain Pondshore20
- 3. Interdunal Swale20
- 4. Semipermanently Flooded (Deep) Emergent Marsh20
 - a. Cattail Marsh21
 - b. Pickerelweed – Mixed Forbs Marsh21
 - c. Phragmites Marsh (non-native)21
- 5. Seasonally Flooded (Shallow) Emergent Marsh21
- 6. Wet Meadow21
- 7. Shrub Swamp22

B. Open Peatlands22

- 1. Acidic Graminoid Fen22
- 2. Coastal Plain Quagmire23
- 3. Sea Level Fen23
- 4. Dwarf Shrub Fen/ Bog23
- 5. Dwarf Tree Bog24
 - a. Black Spruce Shrub Bog24
 - b. Atlantic White Cedar Shrub Bog24

C. Forested Mineral Soil Wetlands.....24

- 1. Floodplain Forest24
 - a. Silver Maple - Sycamore Floodplain Forest25
 - b. Red Maple - Pin Oak Floodplain Forest25
 - c. Red Maple –Ash Swamp (see below)25
- 2. Red Maple Swamp25
 - a. Red Maple - Deciduous Shrub Swamp25
 - a1. Red Maple – Ash Swamp26
 - a2. Red Maple – Black Gum Swamp26
 - a3. Rich Red Maple – Ash Swamp26
 - b. Red Maple – Rhododendron Swamp27
- 3. Swamp White Oak Swamp27
- 4. Hemlock – Hardwood Swamp27
- 5. Vernal Pool27
- 6. Forested Seep28
 - a. Headwater Seep28
 - b. Hillside Seep28
- 7. Spring28

D. Forested Peatlands28

- 1. Atlantic White Cedar Swamp28
 - a. Atlantic White Cedar / Rhododendron Swamp29

b. Atlantic White Cedar – Hardwood Swamp _____	29
b1. Atlantic white cedar – swamp azalea type _____	29
b2. Atlantic white cedar - hemlock - yellow birch type _____	30
2. Black Spruce Bog _____	30
VI. Upland System.	31
A. Open Uplands (non-forested).....	31
1. Inland Sand Barren _____	31
2. Maritime Beach Strand _____	31
3. Maritime Dune _____	31
a. Beach Grass Dune Association _____	32
b. Beach Heather Dune Association _____	32
c. Dune Shrub Association _____	32
4. Maritime Grassland _____	32
5. Maritime Rocky Cliff _____	33
6. Maritime Bluff _____	33
7. Maritime Shrubland (also commonly known as “Coastal Shrubland” _____	33
B. Woodlands	33
1. Maritime Woodland/ Forest _____	34
2. Pitch Pine / Scrub Oak Barrens _____	34
3. Red Cedar Rocky Summit _____	34
C. Forested Uplands	35
1. Oak / Heath Forest _____	35
a. Black Oak - Scarlet Oak / Heath Forest _____	35
b. Chestnut Oak Forest _____	35
c. White Oak / Mountain Laurel Forest _____	35
2. Oak – Hickory Forest _____	36
3. Oak – Holly Forest _____	36
4. Mesic Beech – Maple – Red Oak Forest _____	37
5. High Terrace Riverside Forest _____	37
6. Pitch Pine - Oak Forest _____	37
7. White Pine – Oak Forest _____	38
8. Hemlock – Hardwood Forest _____	38

Note: The naming of community types follows a simplified version of the conventions adopted for the National Vegetation Classification (TNC and NatureServe): Title species are either dominant or simply characteristic of the community. Dashes and slashes between species names indicate similar or different physiognomic strata (tree, shrub or herb layer). For example Oak – Holly Forest indicates that these species are all in one strata compared to Oak / Heath Forest which is comprised of oaks in the tree layer and heath species in a lower strata (in this case shrub layer).

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I. Marine System

This system consists of open ocean, shallow saline coastal bays lacking significant freshwater inflow, and associated high-energy coasts. The limits extend from mean high water seaward, beyond the limits of rooted vascular vegetation. Salinity is greater than 18.0 parts per thousand (ppt) ocean-derived salts.

A. Marine Subtidal. This subsystem includes the area below the lowest tide that is permanently underwater. Salinity levels are fairly constant within a range of 25.0 to 32.0 ppt.

1. Marine Open Water. A broadly defined community describing life in the open ocean from the lowest tide level along the shore to the seaward limits of rooted vascular vegetation, or photic zone and adjacent deeper waters. This community includes all substrate types (ranging from rock bottom to unconsolidated bottom) and has sparse to no rooted vegetation or macroalgae. Associated fauna includes a large number of fish species and mollusks such as surf clam (*Spisula solidissima*) in near-shore waters and ocean quahog (*Artica islandica*) in deeper waters.

Dist: Open ocean along southern coast, around Block Island, extending into Narragansett Bay.

2. Marine Subtidal Aquatic Bed. Community of macroalgae and rooted vegetation occurring in quiet waters below the lowest tide level where fluctuations in salinity are minor. Includes “Eelgrass Beds” and macroalgae beds. Characteristic species include eelgrass (*Zostera marina*), sea lettuce (*Ulva lactuca*), kelp (*Laminaria* spp.), Irish moss (*Chondrus crispus*), and other macroalgae including other *Ulva* spp. (formerly *Enteromorpha*) and *Cladophora*. Many other algae species may be present. Green fleece (*Codium fragile*), a non-native algae, frequently invades this community. Characteristic fauna include bay scallops (*Aequipecten irradians*), northern quahog (*Mercenaria mercenaria*), Atlantic slippershell (*Crepidula fornicata*), and winter flounder (*Pseudopleuronectes americanus*). (See also, closely related Brackish Subtidal Aquatic Bed under Estuarine System).

Dist: In lower Narragansett Bay and Long Island Sound, fringing shore and islands. The Eelgrass Bed association is extremely limited due to losses from eelgrass wasting disease. Eelgrass restoration efforts are ongoing.

B. Marine Intertidal. This subsystem includes the area between the highest and lowest tide levels. The substrate is periodically exposed and flooded by semidiurnal tides, and salinity levels can fluctuate widely.

1. Marine Intertidal Mud Flat. Quiet water community with a substrate composed of silt or sand rich in organic matter and poorly drained at low tide. Microalgae, including diatoms, are a key component of this community and the mud surface is often coated with a thin mat of algae. Characteristic organisms include sand worms (polychaetes), mudsnail (*Ilyanassa obsoleta*), softshell clam (*Mya arenaria*), and blue mussel (*Mytilus edulis*). This community is an important feeding area for shorebirds and some areas may be critical as migratory bird

concentration areas.

Dist: In salt ponds and coves along the seacoast and in Narragansett Bay.

Examples: Quonochontaug Pond, Charlestown; Galilee Salt Marsh, Narragansett.

2. Marine Intertidal Sand/Gravel Beach. Community washed by high-energy waves, with sand and gravel substrates that are well-drained at low tide and subject to high fluctuations in salinity and moisture. It occurs between the low and high tide lines, and the upper edge is often marked by a wrack line of plant debris washed up by the tide. This community is characterized by benthic invertebrate fauna including mole crabs (*Emeritia talpoida*), sand worms (polychaetes), and amphipods, and is an important feeding area for migratory shorebirds, a characteristic species being the sanderling (*Calidris alba*). The Marine Intertidal Sand/Gravel Beach lacks the vascular plants of the Maritime Beach Strand community which occurs above the intertidal zone (see Uplands section).

Dist: Along the seacoast and lower Narragansett Bay.

Examples: Moonstone Beach, South Kingstown; Goosewing Beach, Little Compton.

3. Marine Intertidal Rocky Shore. Community of rocky shores exposed to high-energy waves and alternately exposed and inundated by the tides. Occurs below the high tide line and above the limit of the lowest tide. Organisms include those capable of withstanding wave impact and periodic desiccation, including attached algae, sea mussel (*Mytilus edulis*), sea star (*Asterias* spp.), sea urchin (*Arbacia punctulata*), and rock barnacle (*Balanus balanoides*). The community is typically species rich with over 60% of the substrate covered with attached organisms. Characteristic algae are rockweeds (*Ascophyllum nodosum*, *Fucus* spp.), Irish moss (*Chondrus crispus*), kelp (*Laminaria* spp.), and others (*Ulva/ Enteromorpha* spp., *Rhizoclonium* spp.). Used as winter foraging habitat for purple sandpiper (*Calidris maritima*), harlequin ducks (*Histrionicus histrionicus*) and eider ducks (*Somateria mollissima*).

Dist: Islands and shore of lower Narragansett Bay.

Examples: Sachuest Point National Wildlife Refuge, Middletown; Beavertail Point, Jamestown; Colt State Park, Bristol.

II. Estuarine System

This system consists of deepwater tidal habitats and adjacent tidal wetlands that are semi-enclosed by land but have open, partly obstructed, or ephemeral access to the open ocean, and in which ocean water is partially diluted by freshwater influx. This system extends from the upstream limit of tidal influence seaward to an imaginary line closing the mouth of a bay or river. Salinity is >0.5 parts per thousand (ppt).

A. Estuarine Subtidal. This subsystem includes the area below the lowest tide where the substrate is permanently flooded and continuously submerged.

1. Tidal River/Stream. The aquatic community of continuously flooded substrates that supports no emergent vegetation. A vertical salinity gradient is maintained in which the surface layer of fresh water (0.5 ppt) floats over a deeper brackish layer (0.5 to 18.0 ppt). Characteristic fish are anadromous species including alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and shad (*Alosa sapidissima*).

Dist: Rivers within Narragansett Bay region.

Examples: Pawcatuck River, Narrow River

2. Tidal Creek. Aquatic community of a continuously flooded creek that drains the tidal waters of a coastal salt marsh. Water is brackish to saline (0.5 to 30.0 ppt). Water levels fluctuate with the tides; the creek bottom is permanently flooded, but the banks are exposed at low tide. Characteristic plants include widgeon grass (*Ruppia maritima*) and several cyanophyta. Fiddler crabs (*Uca* spp.) are common burrowers in the banks. Typical fish include mummichog (*Fundulus heteroclitus*), striped killifish (*Fundulus majalis*), and threespine stickleback (*Gasterosteus aculeatus*).

Dist: Tidal marshes along the seacoast and Narragansett Bay.

Example: Galilee Salt Marsh, Narragansett; Seapowet Marsh, Tiverton

3. Brackish Subtidal Aquatic Bed. An estuarine community of continuously flooded substrates supporting rooted aquatic vegetation and associated macroalgae. Water is generally less than 6.6 ft (2 m) deep at low tide, and salinity ranges between 0.5 to 18.0 ppt. The characteristic plant of higher salinity beds is eelgrass (*Zostera marina*) with associated macroalgae including the genera *Ulva* (*Enteromorpha*), *Chaetomorpha*, *Gracilaria*, *Agardhiella*, *Ectocarpus*, and *Pilayella*. Lower salinity beds are characterized by widgeon grass (*Ruppia maritima*), wild celery (*Vallisneria americana*), horned pondweed (*Zannichellia palustris*), sago pondweed (*Potamogeton pectinatus*), clasping-leaved pondweed (*Potamogeton perfoliatus*), and naiads (*Najas* spp.), along with algal forms *Ulva* (*Enteromorpha*), *Cladopora*, and *Chara*. Aquatic beds serve as feeding grounds for American black duck (*Anas rubripes*) and brant (*Branta bernicla*), and nursery grounds for a wide diversity of fish and shellfish. Often adjacent to Brackish Intertidal Flat and/or Brackish Marsh.

Dist: Brackish areas of Narragansett Bay and the permanently flooded portion of coastal salt ponds in Washington and Newport counties.

Examples: Ninigret Pond & Trustom Pond in Charlestown.

4. Coastal Salt Pond. This is a coarsely defined type that includes Intertidal and Subtidal habitats. These brackish ponds occur along the coastal edge, partially closed off from the sea by barrier beaches. Salinity may vary from nearly fresh to nearly saline depending on duration and extent of connection to the sea. Ocean waters enter the pond during storm events or when increased freshwater input on the landward side creates a breach to the ocean that may remain open for short or prolonged periods resulting in wide variations in salinity. Many ponds have been altered on the Rhode Island shore by the construction of permanent breachways. Two types of ponds are recognized: those with significant freshwater input from streams (restricted to eastern R.I.) and those with diffuse freshwater input and little or no stream connection (e.g., Washington County and Block Island). The vegetation is comprised of finer scale communities (which see) nested within this type, including Brackish Marsh, Subtidal Aquatic Bed, and/or Brackish Intertidal Flat. These ponds are also critical nurseries and havens for shellfish and finfish.

Dist: South shore of state and on Block Island.

Examples: Sachem Pond, Block Island; Ninigret and Trustom Ponds, Charlestown; Quicksand Pond, Little Compton.

B. Estuarine Intertidal. This subsystem includes areas between the highest and lowest tide levels where the substrate is regularly exposed and flooded by semi-diurnal tides. Some areas are only irregularly exposed at low tide; other areas are only irregularly flooded at high tide.

1. Brackish Intertidal Flat. A sparsely vegetated community characterized by low-growing, rosette-forming aquatic plants. This community occurs on exposed intertidal mud or sandy flats where vegetation is usually submerged only during highest tides. Water is brackish (0.5 to 16.0 ppt). Flats subject to daily flooding and higher salinity levels may be devoid of macrophytes; characteristic plants of less frequently flooded and more brackish flats include mudwort (*Limosella australis*), horned pondweed (*Zannichellia palustris*), and spike rush (*Eleocharis parvula*), and microalgae. Two plant species typical of this community in Connecticut and Massachusetts but extirpated from Rhode Island are River-arrowhead (*Sagittaria subulata*), and Pygmy-weed (*Crassula aquatica*).

Dist: Brackish ponds and edges of tidal marshes along the seacoast and Narragansett Bay.

Examples: Narrow River, Narragansett; Hundred Acre Cove, Barrington.

2. Brackish Marsh. A marsh community that occurs where water salinity ranges from 0.5 to 18.0 ppt and water levels are 6 ft (2 m). This community consists of a combination of salt marsh and fresh marsh plants. Characteristic species include narrowleaf cattail (*Typha angustifolia*), freshwater cordgrass (*Spartina pectinata*), tall reed (*Phragmites australis*), salt marsh fleabane (*Pluchea odorata*), and rose mallow (*Hibiscus moscheutos*). The robust bulrush (*Scirpus robustus*), three-square bulrush (*Spartina pungens*), and spike rush (*Eleocharis rostellata*) may also be present. This community occurs in several environmental situations including the edges of tidal rivers, coastal ponds that maintain

breachways to the ocean, and small barrier beach ponds that do not maintain permanent breachways, but exhibit higher salinity levels due to salt spray and occasional overwash. Additional study is needed to distinguish these types. This community provides nesting habitat for Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), marsh wren (*Cistothorus palustris*), and other marsh birds.

Dist: Coastal salt ponds and tidal rivers along the coast and Narragansett Bay.

Examples: Trustom Pond, Charlestown; Narrow River, Narragansett; Lathrop Wildlife Refuge at Winnepaug Pond, Westerly; Providence River, Providence and East Providence; Tunipus Pond, Little Compton.

3. Low Salt Marsh. A coastal marsh community in sheltered areas in a zone extending from mean high tide down to sea level, or to about 6.6 ft (2 m) below mean high tide. This community is regularly flooded by semidiurnal tides and is usually limited to the edges of tidal creeks and the borders of tidal flats. The vegetation is often a monotypic stand of salt marsh cordgrass (*Spartina alterniflora*) in combination with dense mats of marine algae such as sea lettuce (*Ulva/Enteromorpha* spp.), rockweeds (*Fucus* spp. and *Ascophyllum nodosus*) and blue green algae. Characteristic animals include fiddler crabs (*Uca* spp.), salt marsh snails (*Littorina* spp.), ribbed mussel (*Geukensia demmisa*), and seaside sparrow (*Ammodramus maritimus*).

Dist: Tidal marshes along the seacoast and Narragansett Bay.

Examples: Galilee Salt Marsh, Narragansett; Touisset Marsh Wildlife Refuge, Warren; Seapowet Marsh, Tiverton; Providence River, Providence and East Providence.

4. High Salt Marsh. A coastal marsh community in sheltered areas in a zone extending from mean high tide up to the limit of spring tidal flooding. This community is irregularly flooded by spring and flood tides. High salt marsh vegetation typically consists of a mosaic of patches, each dominated by a single graminoid species, including salt-meadow cordgrass (*Spartina patens*), spike grass (*Distichlis spicata*), and black grass (*Juncus gerardii*). Other characteristic plants include sea-lavender (*Limonium carolinianum*), salt marsh aster (*Symphyothrichum tenuifolium*; formerly *Aster tenuifolius*), seaside gerardia (*Agalinis maritima*) and spearscale (*Atriplex patula*). The salt marsh snail (*Melampus bidentatus*) is a common animal of this community, and nesting birds include clapper rail (*Rallus longirostris*) and sharp-tailed sparrow (*Ammodramus caudacutus*).

Dist: Tidal marshes along the seacoast and Narragansett Bay.

Examples: Galilee Salt Marsh and Narrow River, Narragansett; Hundred Acre Cove, Barrington; Touisset Marsh, Warren; Emilie Ruecker Wildlife Refuge, Tiverton; Fogland Marsh Preserve, Tiverton

5. Salt Panne. A poorly drained shallow depression within high or low salt marsh communities. Pannes in low marshes have substrates of soft, silty mud, drain irregularly and are usually unvegetated. High marsh pannes are occasionally flooded, the ponded water evaporating and raising salinity to extreme levels. Characteristic plants include dwarf salt marsh cordgrass (*Spartina alterniflora*), glassworts (*Salicornia* spp.), salt marsh plantain

(*Plantago maritima* var. *juncooides*), and sea blites (*Suaeda* spp.). Typically, the surface is covered with a thin, dense algal mat comprised of cyanobacteria and chlorophyta that contributes significantly to biomass production in this community. Within pannes, small ponds may form that are permanently inhabited by fish including mummichog (*Fundulus heteroclitus*) and sheepshead minnow (*Cyprinodon variegatus*).

Dist: Tidal marshes along the seacoast and Narragansett Bay

Examples: Galilee Salt Marsh, Narragansett; Emilie Ruecker Wildlife Refuge, Tiverton.

6. Salt Shrub. A shrubland community that develops at the ecotone of salt marsh and upland where the elevation is somewhat higher than the adjacent salt marsh community and salinity levels are lower. Characteristic shrubs are salt marsh elder (*Iva frutescens*), groundsel-tree (*Baccharis halimifolia*), and pasture rose (*Rosa carolina*), with salt meadow cordgrass (*Spartina patens*) and switchgrass (*Panicum virgatum*) in the herbaceous understory. This community usually occurs as a linear feature along the upper edge of salt marshes, or as shrub islands on higher elevations within large marshes.

Dist: Tidal marshes along the seacoast and Narragansett Bay.

Examples: Galilee Salt Marsh, Narragansett; Fogland Marsh, Tiverton.

III. Riverine System

The riverine system consists of the aquatic communities of flowing waters where salinity is < 0.05 ppt. This system is composed of deepwater habitats (> 6.6 ft) where persistent emergent vegetation is generally lacking, and shallow habitats where submerged or floating-leaved aquatic plants can occur. The Riverine communities are generally restricted to bottoms and aquatic beds in river channels, but may include vegetated shallow water communities along stream margins.

A. Non-tidal River

1. Upper Perennial Stream/River. Upper perennial streams have relatively steep gradients with well-defined riffles and pools. Water flow is constant, fast, and turbulent, and the normal water temperature is cold. Streambeds are narrow, shallow, and there is little floodplain development. Bottom substrates are composed of bedrock, boulder, stone, cobble, and occasional patches of sand. Characteristic fish include brook trout (*Salvelinus fontinalis*), longnose dace (*Rhinichthys cataractae*), blacknose dace (*R. corporalis*), and johnny darter (*Etheostoma nigrum*). Smaller streams may harbor amphibians including two-lined salamander (*Eurycea bislineata*) and dusky salamander (*Desmognathus fuscus*). Mosses and periphytic algae are often present. Aquatic beds may occur locally with macrophytes such as waterweed (*Elodea* spp.), wild celery (*Vallisneria americana*), and pondweeds (*Potamogeton* spp.).

Dist: Throughout Rhode Island.

Examples: Queen, Upper Wood, Ponagansett, and Mossashuck Rivers.

2. Lower Perennial Stream/River. Lower perennial streams have relatively low gradients and poorly defined pools and riffles. Water flow is constant but sluggish, and water temperature fluctuates widely. Streambeds are wide and there is usually a well-developed floodplain. Substrates are composed of finer sands and silts. Characteristic native fish include pumpkinseed (*Lepomis gibbosus*) and chain pickerel (*Esox niger*). Yellow perch (*Perca flavescens*) is a common introduced species. Aquatic beds may be well developed. Typical aquatic macrophytes include waterweed (*Elodea canadensis*), wild celery (*Vallisneria americana*), and linear-leaved pondweeds, such as sago pondweed (*Potamogeton pectinatus*).

Dist: Larger streams/ivers in state, generally lacking in Bristol and Newport Counties, and Block Island.

Examples: Pawcatuck River, Pawtuxet River, Blackstone River.

3. Intermittent Stream. Channels of intermittent streams contain flowing water for only part of the year. When not actively flowing, water may be retained in isolated pools, or surface water may be absent. Faunal representatives include amphibians and invertebrates such as mayflies (Ephemeroptera), caddisflies (Tricoptera), stoneflies (Plecoptera), dragonflies (Odonata) and others that may inhabit the streambed only when water is flowing. Bryophytes such as *Fontinalis* spp. and *Mnium* spp. are characteristic. Intermittent streams are widely distributed throughout the Rhode Island landscape, but more inventories are

needed to distinguish the plant and animal assemblages unique to this community. These reaches are often un-named and many are not shown on topographic maps or GIS stream coverages.

Dist: Throughout Rhode Island.

4. Blackwater Creek. Slow-moving stream through or originating in acidic shrub swamp and/or forested swamps, typically on the coastal plain. Waters are darkly stained with tannins from plant debris. Pondweeds (*Potamogeton* spp.) and waterweeds (*Elodea* spp.) are common. Characteristic of this community is the Blackwater bluet (*Enallagma weewa*), a damselfly that reaches its northern limit in Rhode Island. More inventories are needed to define this community in RI.

Dist: Southern Rhode Island.

Examples: Burlingame State Park, Charlestown.

B. Tidal River (freshwater reach; see Estuarine System for brackish reach)

1. Fresh Subtidal Aquatic Bed. The aquatic community of continuously flooded substrates supporting rooted aquatic vegetation. This community occurs in rivers and streams within the upper limits of tidal fluctuation where salinity is < 0.5 ppt. Characteristic plants are waterweed (*Elodea* spp.), along with wild celery (*Vallisneria americana*), pondweed (*Potamogeton perfoliatus*), and naiads (*Najas* spp.). Note that non-tidal freshwater aquatic beds are included in river and creek communities described above.

Dist: Rare community type in Rhode Island.

Examples: Lower reaches of Pawcatuck River.

2. Freshwater Tidal Marsh. A marsh community occurring at the upper limits of tidal flow along streams and rivers. Salinity levels are < 0.5 ppt and water levels are < 6.6 ft (2 m). This community forms a transition between brackish marsh and nontidal fresh marsh and includes a combination of species typical of both, including narrow-leaved cattail (*Typha angustifolia*), bulrushes (*Scirpus robustus*, *S. pungens*, and *S. validus*), pickerelweed (*Pontederia cordata*), arrowweed (*Sagittaria latifolia*), spatterdock (*Nuphar variegata*), saltmarsh hemp (*Amaranthus cannabinus*) and water-parsnip (*Sium suave*). In addition, several indicator species are found exclusively in these restricted habitats, most notably wild rice (*Zizania aquatica*).

Dist: Very rare community type in Rhode Island; historically on most major rivers in the state before construction of dams.

Examples: Mill Creek, Warwick; Runnins River, East Providence.

IV. Lacustrine System

The lacustrine system consists of waters situated in topographic depressions or dammed river channels. Persistent emergent vegetation is lacking, but areas with submerged or floating-leaved aquatic plants may occur locally. The communities within this system – lakes and ponds – are distinguished by trophic state, annual cycles of thermal stratification, morphometry (size and shape), and water chemistry. Two subcategories of this system that are of particular conservation interest are ponds and lakes that support only native fish (i.e., not stocked with non-native species) and those that are naturally fishless.

A. Mesotrophic Lake. The aquatic community of a relatively nutrient-poor lake. These lakes have two periods of mixing or turnover, spring and fall; they are thermally stratified in summer and winter.. Waters are moderately clear with medium transparency (Secchi disk depths of 2 to 4 meters), and are moderately well-oxygenated. Lake sediments have low to moderate amounts of organic matter. Characteristic native fishes include yellow perch (*Perca flavescens*), Eastern banded sunfish (*Enneacanthus obesus*), and pumpkinseed (*Lepomis gibbosus*). Introduced fish species include smallmouth bass (*Micropterus dolomieu*) and bluegill (*Lepomis macrochirus*). Pondweeds (*Potamogeton* spp.) and bladderworts (*Utricularia* spp.) are the most common submerged macrophytes.

Dist: Throughout Rhode Island.

Example: Wallum Lake, Burrillville.

B. Mesotrophic Pond. A clear, shallow, moderate to low nutrient pond. The substrate is usually sandy or rocky and the ponds are too shallow to become stratified in the summer. Aquatic vegetation is often sparse. Characteristic floating-leaved plants include water-shield (*Brasenia schreberi*) and water-lily (*Nymphaea odorata*), and submerged species include bladderworts (*Utricularia* spp.), pondweeds (*Potamogeton* spp.), and water milfoil (*Myriophyllum* spp.). In shallower waters, rosette-leaved aquatics may occur including pipewort (*Eriocaulon aquaticum*) and water lobelia (*Lobelia dortmanna*). Fish populations are either warm-water or cold-water species, depending on summer temperatures. Those ponds without fish are particularly important breeding sites for some invertebrate and amphibian species. This type grades into and may be hard to distinguish from some examples of the Coastal Plain Pond community (see below) which is characterized by higher plant diversity and greatly fluctuating water levels.

Dist: Throughout Rhode Island.

Examples: Ashville and Blue Ponds, Hopkinton; Carr Pond, West Greenwich; freshwater ponds on Block Island.

C. Coastal Plain Pond. The aquatic (permanently flooded) portion of shallow, clear, nutrient-poor ponds with seasonally fluctuating water levels. These are typically sandy- bottomed, occurring in glacial outwash or on the moraine and are best known for their unique pondshore flora (see Coastal Plain Pondshore community). Technically, some of the smaller or shallower coastal plain ponds fall strictly into the Palustrine System, but all are included here for ease of use of the classification. The pond community itself may be very similar to that of the Mesotrophic Pond above, but occurs in association with the Coastal Plain Pond Shore and/or Coastal Plain Quagmire Communities (which

see). Odonates such as lateral bluet and pine barrens bluet (*Enallagma laterale*, *E. recurvatum*) are characteristic.

Dist: Chiefly in Washington County.

Example: Worden Pond, South Kingstown.

D. Eutrophic Pond. The aquatic community of shallow, nutrient-rich ponds. These ponds are too shallow to become stratified in the summer. Water clarity is usually reduced due to accumulations of algae, and bottom substrates are usually mucky. Aquatic vegetation is abundant with characteristic submersed species including coontail (*Ceratophyllum demersum*), waterweed (*Elodea canadensis*), duckweed (*Lemna* spp.), and pondweeds (*Potamogeton* spp.). Fish populations are comprised of warm-water species. Note this type refers primarily to ponds with naturally high nutrient levels rather than culturally eutrophied waters.

Dist: Throughout Rhode Island.

V. Palustrine System

The palustrine system includes all non-tidal perennial wetlands characterized by emergent vegetation, including wetlands permanently saturated by seepage, permanently flooded, and those seasonally or intermittently flooded (these may be seasonally dry). Vegetative cover is dominated by hydrophytes and the soil types are hydric. Wetland communities are generally distinguished by their plant composition, substrate, and hydrologic regime; however, the boundaries between wetlands are not often discrete and several types may occur together at the same site in a complex mosaic. [User note: substrate (mineral versus organic) is used here as a common organizing feature; but is not critical to identifying the correct community. If uncertain of the substrate type, browse through all of the options under the correct physiognomy (open or forested wetland) to find the best match.]

Open (non-forested) - Trees absent or less than 50% cover or in rare cases, trees > 50% cover but shrub-like; less than 5 m (16 ft) tall.

Forested - Dominated by > 50% canopy cover of woody vegetation, greater than 5 m (16 feet) in height. Vernal pools, forested seeps and springs are included here as these small communities generally occur within forested habitats.

A. Open Wetlands (non-forested) on Mineral Soil. Trees absent or less than 50% cover (or in rare cases, tree species > 50% cover but shrub-like, less than 3m tall). Dominant vegetation is shrub and/or herbs. Substrates are on mineral soils (not peat or muck) or close to bedrock. Fluctuating or variable water levels allow seasonal aeration of the substrate and promote plant litter decomposition, minimizing peat accumulation.

1. Common Pond or Lake Shore (herbaceous community). Sparsely to densely vegetated shoreline of ponds on sand to gravel soils with thin or no peat or muck accumulation. The common Pond or Lake Shore type captures the herbaceous shores of the majority of ponds in Rhode Island, and is characterized by a variety of sedges, annuals and perennials and is habitat for a number of odonates, aquatic invertebrates, amphibians and other species. The rarer subtype of Coastal Plain Pond Shore (below) is characterized by Atlantic coastal plain species or regional endemics and subject to the dramatic fluctuations in water level. Little attention has been paid to the common lake or pond shore community type and the ecological role; additional field data is needed to better describe this type.

Dist: throughout Rhode Island.

Examples: Beach Pond, Hopkinton; Watchaug Pond, Charlestown.

2. Coastal Plain Pondshore. The gently sloping sandy/gravelly shores of ponds in morainal kettle holes, and depressions in glacial outwash plains within the coastal region. Representative floras include a high percentage of species typical of the Atlantic Coastal Plain; several odonates are also characteristic of this community such as New England Bluet and Pine Barrens Bluet (*Enallagma laterale* and *E. recurvatum*). Two variants are described

that may co-occur at some Coastal Plain Ponds and in rare instances the seasonally flooded variant may occur as a wet meadow without a noticeable aquatic community.

a. Seasonally Flooded Coastal Plain Pondshore. Vegetated shores of basin ponds that do not receive above ground inflow. Water levels fluctuate widely in response to water table change, and pond shores and bottoms may be exposed during the growing season. In such cases plants germinate from seeds banked in pond substrates producing vigorous populations that develop as concentric zones of vegetation, from shallow open water to upland shrub borders. More densely vegetated examples have the appearance of wet meadows. Characteristic plants include pipewort (*Eriocaulon aquaticum*), golden-pert (*Gratiola aurea*), umbrella-sedge (*Cyperus dentatus*), narrow-leaved goldenrod (*Euthamia tenuifolia*), mud-rush (*Juncus pelocarpus*), and Virginia meadow beauty (*Rhexia virginica*). Notable rare species include rose coreopsis (*Coreopsis rosea*), narrow-leaved arrowhead (*Sagittaria teres*), New England boneset (*Eupatorium leucolepis* var. *novae-angliae*), horned rush (*Rhynchospora macrostachya*), nutrush (*Scleria reticularis*), bald-rush (*Rhynchospora scirpoides*), umbrella grass (*Fuirena pumila*), rattlebox (*Crotalaria sagittalis*) and tiny-flowered sedge (*Hemicarpha micrantha*).

Dist: Southern Rhode Island.

Examples: Matunuck Hills, S. Kingstown and other isolated examples; most on private lands accessible via guided walks with RIWPS or TNC.

b. Semi-permanently Flooded Coastal Plain Pondshore. Vegetated shores of ponds that maintain relatively constant water levels from perennial stream inflow or recharge from bordering wetlands. Permanent emergent plant communities develop in the littoral zone in water depths of 0 to 3.3 ft (1 m). Characteristic plants include threesquare (*Scirpus pungens*), bayonet rush (*Juncus militaris*), water lobelia (*Lobelia dortmanna*), pennywort (*Hydrocotyle umbellata*), yellow-eyed grass (*Xyris difformis*). Horsetail spike-rush (*Eleocharis equisetoides*) may be present. (See also related Coastal Plain Quagmire).

Dist: Southern Rhode Island.

Examples: Tucker Pond and Worden Pond, S. Kingstown.

3. Interdunal Swale. Small wetlands that occur in low areas and blowouts within coastal sand dunes where the water table is at or near the surface. Soils are sand to peaty sand and water levels fluctuate seasonally and annually, corresponding to changes in groundwater levels. Vegetation ranges from sparse to dense, and from graminoid-dominated to low shrub mats. Characteristic species are rushes (*Juncus canadensis*, *J. greenii*), beakrush (*Rhynchospora capitellata*), yellow-eyed grass (*Xyris torta*), cranberry (*Vaccinium macrocarpon*), sweet gale (*Myrica gale*), and northern bayberry (*Morella pensylvanica*; formerly *Myrica pensylvanica*).

Dist: Rare community type along the south shore and Block Island.

Example: Quonochontaug Beach, Charlestown.

4. Semipermanently Flooded (Deep) Emergent Marsh. Marsh community on mineral soils

with water depths ranging from 6 in. to 6.6 ft (15 cm to 2 m). Water levels may fluctuate seasonally but the substrate is rarely dry. May occur as fringe marshes along rivers, pond margins, or in basins. Characteristic vegetation is composed of emergent aquatics including cattails (*Typha latifolia* and *T. angustifolia*), bayonet rush (*Juncus militaris*), softstem bulrush (*Scirpus tabernaemontani*), pickerelweed (*Pontedaria cordata*), arrow arum (*Peltandra virginica*), and burreed (*Sparganium* spp.). Floating-leaved plants include spatterdock (*Nuphar variagata*), water lily (*Nymphaea odorata*) and pondweeds (*Potamogeton* spp.). The non-native common reed (*Phragmites australis*) is a frequent invader of this community. Species composition of each community is highly variable depending on hydrologic regime, topographic position, and substrate. The *Typha* dominated “Cattail Marsh” is the most familiar form of this community. Red-winged blackbird (*Agelaius phoeniceus*) and Virginia rail (*Rallus limicola*) are common residents along with several state-rare species including marsh wren (*Cistothorus palustris*) and pied-billed grebe (*Podilymbus podiceps*).

Dist: Throughout Rhode Island.

Examples: Simmons Mill Pond, Little Compton; Lonsdale Marsh/Valley Marsh Conservation Area, Lincoln.

Several common types are based on the dominant species are:

a. Cattail Marsh

b. Pickerelweed – Mixed Forbs Marsh

c. Phragmites Marsh (dominated by the non-native invasive variety; the native *Phragmites* is known only from small patches)

5. Seasonally Flooded (Shallow) Emergent Marsh. Marsh community on mineral or muck soils that are permanently saturated and seasonally flooded. Water depths range from 6 in. to 3.3 ft (15 cm to 1 m) during flood stages, but levels usually drop in mid to late summer exposing the substrate. Dominant plants include rice cutgrass (*Leersia oryzoides*), cattails (*Typha* spp.), soft rush (*Juncus effusus*), Canada rush (*Juncus canadensis*), reed canary grass (*Phalaris arundinacea*), bluejoint (*Calamagrostis canadensis*), arrow arum (*Peltandra cordata*), manna grass (*Glyceria canadensis*), wool grass (*Scirpus cyperinus*), three-way sedge (*Dulichium arundinaceum*), tussock sedge (*Carex stricta*), and wild iris (*Iris versicolor*). Faunal associates include common yellowthroat (*Dendroica petechia*), red-winged blackbird (*Agelaius phoeniceus*), marsh wren (*Cistothorus palustris*, state-rare), wood frog (*Rana sylvatica*), spring peeper (*Pseudoacris crucifer*), a wide diversity of odonates (dragonflies and damselflies), and other species.

Dist: Throughout Rhode Island.

Examples: Blackstone Valley Marshes, Cumberland and Lincoln.

6. Wet Meadow. Graminoid and forb dominated meadows on soils that are seasonally saturated or flooded, but are drier and without standing water for most of the year. In a

natural setting, the high water table prevents tree species from taking hold; however, wet meadows are often associated with agricultural settings, where woody species are kept at bay in part by grazing and/or mowing practices. Species composition is highly variable, but typically co-dominated by several species. Characteristic plants include Joe-pye-weed (*Eupatorium* spp.), wool-grass (*Scirpus cyperinus*), soft rush (*Juncus effusus*), sensitive fern (*Onoclea sensibilis*), marsh fern (*Thelypteris palustris*), St. Johnswort (*Hypericum* spp.), sedge (*Carex stipata*), tussock sedge (*Carex stricta*), and bluejoint grass (*Calamagrostis canadensis*). Goldenrods (*Solidago* spp.) may be conspicuous in some meadows. Scattered shrubs may occur, but comprise less than 30% percent cover. Wet meadows are rich habitats for invertebrates, especially butterflies and other nectar feeders.

Dist: Throughout the state.

Examples: Pardon Gray Preserve, Tiverton; Sprague Hill Farm, Gloucester.

7. Shrub Swamp. Wetland communities dominated by shrubs 0.5 to 5 m tall that occur along the margin of a pond or river, isolated in a wet depression or valley, or as a transition community between a marsh and upland communities. The substrate is usually mineral soil or muck. This type is highly variable with the dominant shrub species dictated by local conditions, including water depth, topographic position, and microclimate. At wetter sites buttonbush (*Cephalanthus occidentalis*) or water willow (*Decodon verticillatus*) may dominate with over 90% cover. Sites not permanently flooded may support a mix of shrubs with characteristic species including highbush blueberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), winterberry (*Ilex verticillata*), alders (*Alnus incana* and *A. serrulata*), silky dogwood (*Cornus amomum*), maleberry (*Lyonia ligustrina*), spicebush (*Lindera benzoin*), meadow-sweet (*Spiraea latifolia*), steeplebush (*Spiraea tomentosa*), and swamp azalea (*Rhododendron viscosum*). When present, trees form an emergent canopy of less than 26% cover.

Dist: Widespread across state.

Examples: Ten Mile River bikepath, East Providence; Chapman Pond, Westerly.

Examples of more common types, based on the dominant species are:

1. Buttonbush Swamp (*Cephalanthus occidentalis*)
2. Water Willow Swamp (*Decodon verticillatus*)
3. Alder Swamp (*Alnus* spp.)
4. Red-osier Dogwood – Willow Swamp (*Cornus sericea* – *Salix* spp.)
5. Highbush Blueberry Swamp (*Vaccinium corymbosum*)

B. Open Peatlands. Includes wetlands with < 50% canopy cover of trees, the dominant vegetation being shrubs, herbs, and mosses. Substrates consist of accumulated organic deposits consisting of coarse fibrous or woody peat, or well-decomposed organic soils (mucks). Permanent saturation reduces aeration of the substrate, thereby slowing decomposition of plant litter and allowing accumulation of peat. Areas with longer-term flooding tend to accumulate more peat.

1. Acidic Graminoid Fen. A weakly minerotrophic peatland fed by groundwater containing minerals obtained during passage through or over mineral soils or aquifers. The substrate is

peat composed primarily of Sphagnum. Sedges dominate, characterized by one or several of the following: slender sedge (*Carex lasiocarpa*), bog-sedge (*Carex exilis*), beaked sedge (*Carex urticulata* or *C. rostrata*), and twig-rush (*Cladium mariscoides*). Less common species include grasses such as mannagrass (*Glyceria canadensis*, *G. striata*, and *Puccinellia pallida*), or rare species such as Walter's sedge (*Carex walteriana*) and Long's bulrush (*Scirpus longii*). Associates are white beakrush (*Rhynchospora alba*), three-way sedge (*Dulichium arundinacea*), marsh St. Johnswort (*Triadenum virginicum*), cranberry (*Vaccinium macrocarpon*) and round-leaved sundew (*Drosera rotundifolia*). Mosses (*Sphagnum* spp.) are frequent and may form solid mats or are suspended in the water. Shrubs such as leatherleaf (*Chamaedaphne calyculata*), sweet gale (*Myrica gale*), highbush blueberry (*Vaccinium corymbosum*) and others are often present but at < 50% cover.

Dist: Throughout Rhode Island.

Examples: Great Swamp, South Kingstown; Diamond Bog, Richmond; Sprague Hill, Gloucester.

Variants: The Three-way sedge / Sphagnum Association (*Dulichium arundinaceum* / *Sphagnum* spp.) is well represented in Rhode Island, often occurring at the edges of larger fens as well as in small, isolated, woodland basins that are prone to fluctuating water levels. This association is characterized by a suspended layer of sphagnum mosses (*S. fallax*, *S. cuspidatum*, and others).

2. Coastal Plain Quagmire. Community of shallow depressions on permanently flooded muck soils with water depths ranging from 16 cm to 0.6 m. Deeper water sections may be devoid of emergent vegetation, but shallow sections usually support dense patches of emergent plants. Characteristic species include twig rush (*Cladium mariscoides*), white beak-rush (*Rhynchospora alba*), drowned beak-rush (*R. inundata*), yellow-eyed grass (*Xyris smalliana*), horsetail spikerush (*Eleocharis equisetoides*), water lily (*Nymphaea odorata*), threesquare (*Scirpus pungens*), and Canada rush (*Juncus canadensis*). See also related Coastal Plain Pond Shore.

Dist: Southern Rhode Island; a rare community type.

Examples: Grass Pond, Richmond; Phantom Bog and Shumunkanuc Bog, Hopkinton.

[Note: these areas are not readily accessible to public except by guided trips.]

3. Sea Level Fen. A rare community type that develops in the upper border of tidal marshes where there is freshwater influx usually from groundwater seepage. The best Rhode Island example is found on the inland side of a coastal salt pond that receives freshwater percolating from the adjacent moraine. Characteristic species include twig-rush (*Cladium mariscoides*), spikerush (*Eleocharis rostellata*), and threesquare (*Scirpus pungens*).

Dist: Two examples known in Westerly and Narragansett.

4. Dwarf Shrub Fen/ Bog. An oligotrophic peatland usually occurring in a basin fed directly by rainfall, with little or no stream inflow. Water is nutrient-poor and acidic. This type is dominated by Sphagnum and > 50% cover of shrubs < 1 m tall, the principal species being leatherleaf (*Chamaedaphne calyculata*). Other shrubs may include sheep laurel (*Kalmia*

angustifolia), highbush blueberry (*Vaccinium corymbosum*), cranberry (*Vaccinium macrocarpon*), black huckleberry (*Gaylussacia baccata*), and dwarf huckleberry (*G. dumosa* var. *bigeloviana*). Herbs include pitcher plant (*Sarracenia purpurea*), round-leaved sundew (*Drosera rotundifolia*), rose pogonia (*Pogonia ophioglossoides*), cotton grasses (*Eriophorum* spp.), and white beak-rush (*Rhynchospora alba*). Scattered saplings of white cedar (*Chamaecyparis thyoides*) and red maple (*Acer rubrum*) may be present. Rare plants are represented by species of northern affinities, including pod-grass (*Scheuchzeria palustris*), pale laurel (*Kalmia polifolia*), and bog rosemary (*Andromeda glaucophylla*).

Dist: Throughout Rhode Island.

Examples: Great Swamp, South Kingstown; Diamond Bog, Richmond; Schwindel's Swamp, Gloucester.

5. Dwarf Tree Bog. An oligotrophic peatland dominated by tree species that are in dwarf form (not simply young trees). Rare community type in RI; see Forested Wetlands for more common version of bogs dominated by conifers.

a. Black Spruce Shrub Bog. An ombrotrophic or oligotrophic peatland, occurring in a basin fed directly by rainfall with little groundwater influence or as floating islands in man made reservoirs. The dominant woody plant is black spruce (*Picea mariana*) with most individuals < 5 m (16 feet) tall. A well-developed shrub layer is characterized by leatherleaf (*Chamaedaphne calyculata*) and rhodora (*Rhododendron canadense*), and herbaceous plants generally include species listed for dwarf shrub bog. (see Black Spruce Bog for forested type)

Dist: Rare community type, several examples in Providence County.

b. Atlantic White Cedar Shrub Bog. An oligotrophic (low-nutrient) peatland in a basin setting. The dominant woody plant is Atlantic white cedar (*Chamaecyparis thyoides*) with all individuals growing in a dwarfed form < 2 m tall (6 feet) and 10 cm (4 inches) diameter. Associated shrubs include dwarf huckleberry (*Gaylussacia dumosa* var. *bigeloviana*), leatherleaf (*Chamaedaphne calyculata*), and small cranberry (*Vaccinium oxycoccus*), and predominant herbs include cotton-grass (*Eriophorum* spp.), white beak-rush (*Rhynchospora alba*), yellow-eyed grass (*Xyris torta*), pitcher plant (*Sarracenia purpurea*), and horned bladderwort (*Utricularia cornuta*). (See related type: Forested peatland – Atlantic White Cedar Swamp).

Dist: This community is represented by one Rhode Island example at Factory Pond, S. Kingstown.

C. Forested Mineral Soil Wetlands. This subsystem includes seasonally flooded forests and permanently flooded or saturated swamps on mineral soils, well-decomposed mucks or shallow to deep peat. These wetlands are dominated by a > 60% canopy cover of woody vegetation, 5 m (16+ ft.) in height.

1. Floodplain Forest. Hardwood forest on river floodplains. Low areas receive annual overbank flooding, usually in the spring but occasionally in fall as well. The water table may

be well below ground surface for much of the growing season. A broadly defined community, floodplain forests are variable based on frequency and duration of flooding, size of river, topography, and substrate.

a. Silver Maple - Sycamore Floodplain Forest. Typical of floodplains along main stem of rivers in northern part of state. Silver maple (*Acer saccharinum*) is almost always present. Other characteristic trees include, box elder (*Acer negundo*), sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*) and elm (*Ulmus americana*, *U. rubra*). Red maple (*A. rubrum*) and green ash (*Fraxinus pensylvanica*) are often present but not the dominant species. Characteristic herbs include wood nettle (*Laportea canadensis*), jack-in-the-pulpit (*Arisaema triphyllum*) and ostrich fern (*Matteuccia struthiopteris*, rare in RI).

Dist: Most characteristic along the larger rivers such as the Blackstone, but also characteristic of main stems of smaller rivers in Providence County. Occasional in other parts of the state.

Examples: Blackstone River, Cumberland; Ten Mile River, East Providence.

b. Red Maple - Pin Oak Floodplain Forest. Typical of floodplains in the lower Pawcatuck River system. Dominant trees include red maple (*Acer rubrum*), pin oak (*Quercus palustris*), and green ash (*Fraxinus pensylvanica*). Associates are swamp white oak (*Quercus bicolor*), hickory (*Carya* sp.), white oak (*Quercus alba*), winterberry (*Ilex verticillata*), sensitive fern (*Onoclea sensibilis*) and a sedge (*Carex crinita*).

Dist: Pawcatuck River, Washington County

Examples: Pawcatuck River, Bradford.

c. Red Maple – Ash Swamp (variant of Red Maple Swamp; see below). This type is common on floodplains as well as in shallow basins.

Examples: Fort Nature Refuge, N. Smithfield; Weetamoo Woods, Tiverton; Fisherville Brook Wildlife Refuge, Exeter.

2. Red Maple Swamp. Dominated by hardwoods with the dominant tree species being red maple. Small percent cover (less than 25%) of conifers may be present, including hemlock (*Tsuga canadensis*), Atlantic white cedar (*Chamaecyparis thyoides*), and white pine (*Pinus strobus*).

a. Red Maple – Deciduous Shrub Swamp. Overstory dominated by red maple (*Acer rubrum*) with an understory of mixed deciduous shrubs including highbush blueberry (*Vaccinium corymbosum*), spicebush (*Lindera benzoin*), sweet pepperbush (*Clethra alnifolia*), winterberry (*Ilex verticillata*), elderberry (*Sambucus canadensis*), and swamp azalea (*Rhododendron viscosum*). Associated tree species include black gum (*Nyssa sylvatica*), yellow birch (*Betula alleghaniensis*), green ash (*Fraxinus pensylvanica*), white ash (*Fraxinus americana*) and scattered conifers. Skunk cabbage (*Symplocarpus foetidus*) and cinnamon fern (*Osmunda cinnamomea*) are

nearly always present. Other herbs are Turk's-cap lily (*Lilium superbum*), tussock sedge (*Carex stricta*), false hellebore (*Vertatrum viride*), jewelweed (*Impatiens capensis*), false nettle (*Boehmeria cylindrica*), royal fern (*Osmunda regalis*) and others. Sphagnum mosses are common on hummocks but rarely form extensive carpet. Occurs in basins, seepage swamps, and on floodplains of small rivers across the state.

Dist: Throughout Rhode Island.

Examples: Burlingame State Park, Charlestown; Great Swamp Management Area, Kingston; Wickaboxet State Forest, West Greenwich; Fort Nature Refuge, N. Smithfield.

Variants: The first 2 variants often co-occur and can be hard to distinguish in some cases. All species occur in both settings to some degree and one must rely on the full suite of characteristics to help distinguish intermediate examples. The third variant is restricted to sites with calcareous influence and is very limited in the state.

a1. Red Maple – Ash Swamp: Red maple (*Acer rubrum*), green ash (*Fraxinus pensylvanica*), white ash (*F. americana*), spicebush (*Lindera benzoin*), skunk cabbage (*Symplocarpus foetidus*), and false hellebore (*Vertrum viride*) are characteristic; the spicebush often forming a conspicuous shrub layer. This community is frequent along small streams and in seasonally flooded basins. Hummocks and a conspicuous moss component may be present or absent depending on flooding regime. Lacking calcareous indicators in the herb layer in contrast to the Rich Red Maple – Ash Swamp variant below.

a2. Red Maple – Black Gum Swamp: Red maple (*Acer rubrum*) and black gum (*Nyssa sylvatica*) dominate the canopy. Other tree species may occur in less abundance. Associates include highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), winterberry (*Ilex verticillata*), cinnamon fern (*Osmunda cinnamomea*), tussock sedge (*Carex stricta*). Moss covered hummocks (*Sphagnum* mosses and others) are typical. Typically occurs in shallow basins subject to seasonal flooding, with soils remaining saturated longer than in the Red Maple – Ash Swamps.

a3. Rich Red Maple – Ash Swamp: Deciduous or mixed swamp that is somewhat enriched by groundwater flow through circumneutral to calcareous substrate. Co-dominants are red maple and white ash and/or green ash (*Fraxinus americana*, *F. pensylvanica*) with lower abundance of yellow birch (*Betula alleghaniensis*), hemlock (*Tsuga canadensis*), Atlantic white cedar (*Chameacyparis thyoides*) and/or white pine (*Pinus strobus*). In adjacent states, black ash (*F. nigra*) is typical, but this species not documented in RI. The groundlayer tends to be quite diverse, including species such as swamp saxifrage (*Saxifraga pensylvanica*), golden ragwort (*Senecio aureus*), royal

fern (*Osmunda regalis*), and mosses (e.g., *Sphagnum* spp., *Campylium* sp., etc.).

Dist: Rare in RI, limited to northern part of state.

Example: Ash Swamp, Cumberland

b. Red Maple – Rhododendron Swamp. Overstory dominated by red maple (*Acer rubrum*) with Atlantic white cedar (*Chamaecyparis thyoides*) usually present. Understory dominated by great laurel or rhododendron (*Rhododendron maximum*) with lesser representation by sweet pepperbush (*Clethra alnifolia*) and swamp azalea (*Rhododendron viscosum*). Herbs are sparse, with most common species being skunk cabbage (*Symplocarpus foetidus*), Jack-in-the-pulpit (*Arisaema triphyllum*), and cinnamon fern (*Osmunda cinnamomea*).

Dist: Washington County, north of Charlestown recessional moraine.

Example: Ell Pond Preserve, Hopkinton.

3. Swamp White Oak Swamp. A hardwood forested swamp community dominated by swamp white oak (*Quercus bicolor*). Associates may include black gum (*Nyssa sylvatica*) and red maple (*Acer rubrum*). Understory is sparse and patchy, with highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), buttonbush (*Cephalanthus occidentalis*), cinnamon fern (*Osmunda cinnamomea*) and/or royal fern (*Osmunda regalis*). Water levels are seasonally high, but draw down for much of the year. The extent of the flooding can often be discerned from water marks left on tree trunks and trees may show a buttressing effect at the base.

Dist: Not well documented in Rhode Island; presumed to be uncommon. Known from northern part of state; needs more study.

4. Hemlock – Hardwood Swamp. A mixed coniferous/ deciduous swamp occurring on mineral soils in depressions receiving groundwater discharge. Characterized by a closed canopy (70 to 100% cover), sparse shrub layer, and low species diversity. Canopy is dominated by hemlock (*Tsuga canadensis*) (usually > 50% cover), with lesser representation by yellow birch (*Betula alleghaniensis*) and red maple (*Acer rubrum*). The most common shrub is highbush blueberry (*Vaccinium corymbosum*). Characteristic herbs include cinnamon fern (*Osmunda cinnamomea*) and sensitive fern (*Onoclea sensibilis*). Water levels fluctuate seasonally.

Dist: Throughout Rhode Island.

Example: George Washington Management Area, Glocester.

5. Vernal Pool. A wetland in a small, shallow depression within an upland forest, usually less than 0.25 acres and flooded for only a portion of the year. These pools are typically flooded in the spring (vernal), occasionally only in the fall or after heavy rainfall, and usually dry during summer. Some spring-flooded pools are filled again in autumn. This community includes invertebrates and amphibians that depend on temporary pools as breeding areas because they do not support fish populations that would prey on eggs or larvae. Characteristic obligate amphibians include wood frog (*Rana sylvatica*), mole salamanders

(*Ambystoma* spp.), and Eastern spadefoot (*Scaphiopus holbrookii* - rare). Other species may include green frog (*Rana clamitans*), spring peeper (*Pseudacris crucifer*), and American toad (*Bufo americanus*). Fairy shrimp (*Eubranchipus* spp.) are characteristic, but more data is needed on other invertebrates and plants. These communities are generally missing from wetland map coverage due to their small size.

Dist: Throughout Rhode Island.

Examples: Francis Carter Preserve, Charlestown RI; Weetamoo Woods, Tiverton; Fisherville Brook Wildlife Refuge, Exeter.

6. Forested Seep. Small, often overlooked wetland community at the site of small springs, or where groundwater seeps to the surface at the base or middle of a slope. Seeps are usually small (<0.25 acre), with a canopy cover of trees at the edge of the seep or growing on hummocks. A diversity of mosses is characteristic and sedges (*Carex* spp.), marsh blue violet (*Viola cucullata*) and other wetland herbs are common. Shrub cover is typically sparse, with species such as spicebush (*Lindera benzoin*), highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), and/or dogwood (*Cornus* spp.). Animal associates include northern dusky salamander (*Desmognathus fuscus*), four-toed salamander (*Hemidactylium scutatum*), and the gray petaltail (*Tachopteryx thoreyi*) dragonfly (hillside seeps). Seeps can be considered a component of upland forests as they are typically too small to be captured on many wetland mapping coverages.

Dist: throughout the state; most commonly at the headwaters of many of our streams, but also in isolated locales on slopes.

Variants: More information is needed on this community in Rhode Island including inventory of mosses and invertebrates. Two familiar variants are:

a. Headwater Seep – at the headwaters of small streams, characterized by lush moss cover. Often occurs as a linear feature uphill of the defined stream channel.

b. Hillside Seep – on slopes, either along streams or isolated in forest setting.

7. Spring. Small localized woodland pool fed by groundwater bubbling to the surface. Vegetation may be sparse, in some cases absent. Watercress (*Nasturium officianale*) is the most typical plant. Many of these sites are known or mapped due to their historical value as a source of drinking water, in some cases modified by stone structures built to hold water for this reason. The Northern spring salamander (*Gyrinophilus porphyriticus*) is a rare inhabitant of springs in northern part of the state.

D. Forested Peatlands. Wetlands with over 60% canopy cover of trees growing on peat (accumulated organic deposits of coarse fibrous or woody plant material) or well-decomposed organic soils (mucks). Prolonged high water tables reduce aeration of the substrate, thereby slowing decomposition of plant litter and allowing accumulation of peat. Areas with longer-term flooding tend to accumulate more peat.

1. Atlantic White Cedar Swamp. An evergreen or mixed swamp occurring on organic soils in poorly drained depressions, occasionally along streams. Atlantic white cedar

(*Chamaecyparis thyoides*) comprises > 50% of the canopy cover; in mixed stands, red maple (*Acer rubrum*) is the codominant. A characteristic invertebrate is Hessel's hairstreak butterfly (*Mitoura hesseli*), an obligate *Chamaecyparis* feeder. Recognized community variants include the following:

a. Atlantic White Cedar / Rhododendron Swamp

Shrub layer dominated by great laurel or rhododendron (*Rhododendron maximum*). Tree canopy is dominated by white cedar, with lesser associates including red maple, yellow birch (*Betula alleghaniensis*), hemlock (*Tsuga canadensis*) and black gum (*Nyssa sylvatica*). Herbaceous layer is depauperate beneath a closed canopy, with mosses (primarily *Sphagnum*) predominant. Sites supporting this type are seasonally saturated and have potential for considerable water level fluctuation. Basin swamps overly stratified drift, glacio-lacustrine deposits, and till with low pH, and a high level of organic decomposition.

Dist: Washington County.

Example: Ell Pond/Long Pond, Hopkinton

b. Atlantic White Cedar – Hardwood Swamp

Mixed association of evergreen/deciduous trees with Atlantic white cedar predominating, but canopy always includes significant amounts of red maple, yellow birch, and/or hemlock. White pine (*Pinus strobus*) may also be present. The shrub layer is diverse with sweet pepperbush (*Clethra alnifolia*) and highbush blueberry (*Vaccinium corymbosum*) being the most frequent components. Other sporadically occurring shrubs include winterberry (*Ilex verticillata*), maleberry (*Lyonia ligustrina*), mountain laurel (*Kalmia latifolia*), smooth winterberry (*Ilex laevigata*), and fetterbush (*Eubotrys racemosa*, formerly *Leucothoe racemosa*). Common in the herb layer are starflower (*Trientalis trifolia*), goldthread (*Coptis groenlandica*), several sedges (*Carex trisperma*, *C. stricta*, *C. folliculata*), skunk cabbage (*Symplocarpus foetidus*) and marsh fern (*Thelypteris palustris*).

Dist: across the state; largest examples in Washington County.

Examples: Great Swamp, Kingston and Crandall (Chapman) Swamp, Westerly.

Two expressions have been described in RI and CT, but are not consistently distinguishable in the field, therefore they are not split into separate variants in this document. Based on analysis of plot data, understory composition appears to vary depending on canopy composition. In addition to the typical suite of species listed above (especially sweet pepperbush and highbush blueberry), characteristic species are noted below.

b1. Atlantic white cedar – swamp azalea type tends to be dominated by white cedar with a small percentage of red maple, and is characterized by swamp azalea (*Rhododendron viscosum*) and/or mountain holly (*Nemopanthus mucronata*). Sites supporting this association occur in semipermanently to

seasonally flooded streamside or lakeshore habitats where water levels remain high into the growing season and fluctuation is lessened.

b2. Atlantic white cedar - hemlock - yellow birch type is typically co-dominated by cedar and either hemlock (*Tsuga canadensis*) and/or yellow birch (*Betula allegheniensis*). Characteristic understory species are mountain laurel (*Kalmia latifolia*), cinnamon fern (*Osmunda cinnamomea*) and/or royal fern (*Osmunda regalis*), and three-seeded sedge (*Carex trisperma*). Occurs in seasonally saturated basin swamps and seasonally flooded streamsid es.

2. Black Spruce Bog. A conifer swamp of acidic peatlands in cool, poorly-drained depressions. The dominant tree > 5 m (16 feet) tall is black spruce (*Picea mariana*). A well-developed shrub layer is characterized by leatherleaf (*Chamaedaphne calyculata*) and rhodora (*Rhododendron canadense*). (This community differs from the Black Spruce Shrub Bog by the height and density of trees.) A widespread type of northern New England, this community is represented by only one example in R.I.

Dist: Limited to Washington County.

Example: Arcadia Management Area, Exeter.

VI. Upland System.

This system consists of upland communities, forested and non-forested, which have well-drained soils that are xeric to mesic (never hydric), and a vegetative cover that is never dominated by hydrophytes, even if the soil surface is seasonally flooded or saturated. Communities described as Maritime are those restricted to areas along the coastal edge that are regularly influenced by salt spray.

A. Open Uplands (non-forested). Dominated by shrubs and/or herbaceous species, or sparsely vegetated communities.

1. Inland Sand Barren. Sparsely vegetated community on shifting sands that are not along the ocean shore. Occurs within pitch pine forest or woodland types, generally occurring as patches of < 2 acres. Vegetation is patchy, usually on < 75% of surface area, consisting of lichens (especially *Cladonia* spp.), heather (*Hudsonia tomentosa*), little bluestem (*Schizachyrium scoparium*), umbrella sedge (*Cyperus filiculmis*), and sand jointweed (*Polygonella articulata*). The sand star fungus (*Astraeus hygrometricus*; formerly *Geaster hygrometricus*) is typically present. Characteristic insects include tiger beetles (*Cicindela* spp.) and parasitic wasps (Hymenoptera). This is a very rare community type, many examples across the region have been lost to development but several high quality examples occur on protected lands in Rhode Island.

Dist: Washington, Kent and Newport Counties.

Examples: Pawcatuck River Barrens, Hopkinton; Queens River Preserve (TNC), Exeter.

2. Maritime Beach Strand. A sparsely-vegetated community that occurs on unstable sand, gravel or cobble beaches above mean high tide and in overwash zones, where the shore is modified by storm waves and wind erosion. Vegetation may be scarce and ephemeral due to the instability of substrates. Characteristic plants include sea-rocket (*Cakile edentula*), orach (*Atriplex patula*), seabeach sandwort (*Honkenya peploides* var. *robusta*), common saltwort (*Salsola kali*), and seabeach knotweed (*Polygonum glaucum*). Tiger beetles (*Cicindela* spp.) are notable invertebrate residents and the federally threatened piping plover (*Charadrius melodus*) feeds and nests in this community. Co-occurs with the Marine Intertidal Sand/Gravel Beach (see Marine System) which is below the tide line

Dist: Rhode Island coast; best represented on RI's southern shores and Block Island.

3. Maritime Dune. A community dominated by grasses and low shrubs on sand dunes inland of and adjacent to maritime beaches. Vegetation occurs in patches resulting from past disturbances such as erosion, sand deposition, and dune migration. The composition and structure of the vegetation is dependent on dune stability, degree of deposition and erosion, and distance from the ocean.

Dist: On barrier beaches along south shores of RI and Block Island. Examples: Block Island; Moonstone Beach, South Kingstown; Roger Wheeler Beach, Narragansett; Goosewing Beach, Little Compton.

a. Beach Grass Dune Association. A sparse to densely vegetated grass-dominated association on the active portions of primary dunes where sand shifting is the greatest. Along with beach grass (*Ammophila breviligulata*), characteristic species include beach-pea (*Lathyrus japonicus*), seaside goldenrod (*Solidago sempervirens*), sandy sedge (*Carex silicea*), and several non-native (introduced) species including dusty-miller (*Artemisia stellariana*) and sand rose (*Rosa rugosa*). Switchgrass (*Panicum virgatum*) may be dominant in patches. The non-native strain of phragmites (*Phragmites australis*) also invades this community, often becoming established first in adjacent water bodies and wetlands and spreading by rhizomes into open uplands.

b. Beach Heather Dune Association. Association dominated by dwarf shrubs or perennial forbs on the more stabilized portions of primary and secondary dunes where sand shifting is reduced. Characteristic species include beach heather (*Hudsonia tomentosa*), bearberry (*Arctostaphylos uva-ursi*), jointweed (*Polygonella articulata*), and beach pinweed (*Lechea maritima*).

c. Dune Shrub Association. Dominated by medium height woody vegetation in the somewhat protected areas of sandy maritime dunes and atop coastal bluffs. Vegetation includes northern bayberry (*Morella pensylvanica*; formerly *Myrica pensylvanica*), beach-plum (*Prunus maritima*), and poison ivy (*Toxicodendron radicans*). The non-native sand rose (*Rosa rugosa*) has become naturalized in this setting, sometimes crowding out native species.

(for Interdunal Swale see Palustrine System)

4. Maritime Grassland. A sparsely vegetated community on rolling morainal topography of Block Island, generally on areas exposed to periodic wind and salt spray. Small examples likely occurred on exposed south shores of bay islands (e.g., Aquidneck and perhaps some smaller ones) but have been altered by land use and encroachment of invasives. This community is dominated by grasses and forbs and is generally found on upper slopes and crests of hills. Examples are relatively small in area (< 1 acre) and tend to be surrounded on downslope sides by maritime shrubland communities. Characteristic plant species include little bluestem (*Schizachyrium scoparium*), grass-leaved goldenrods (*Euthamia graminifolia* and *E. tenuifolia*), bitter milkwort (*Polygala polygama*), white-topped Aster (*Sericocarpus asteroides*; formerly *Aster paternus*), rush (*Juncus greenei*), and grasses. Rare species found in this setting include bushy rockrose (*Helianthemum dumosum*), northern blazing-star (*Liatris scariosa* var. *novae-angliae*), Maryland golden aster (*Chrysopsis mariana*), and purple three-awn (*Aristida purpurescens*). Note: This community type should not be confused with the large grasslands and hayfields on Block Island that are anthropogenically maintained.

Dist: Primarily on Block Island

Example: Lewis/Dickens Farm; Turnip Farm.

5. Maritime Rocky Cliff. A community on exposed bedrock outcrops along the shore receiving direct impacts of wind and salt spray. Plant communities vary from sparse on dry sites, to more diverse in patches where freshwater seepage emerges near the crest of cliffs and trickles down rock crevices. Characteristic plants include threesquare rush (*Scirpus americanus*), pearlwort (*Sagina procumbens*), rush (*Juncus marginatus*), and seaside plantain (*Plantago maritima* var. *juncoides*). The exotic (non-native) scarlet pimpernel (*Anagallis arvensis*) is a notable inhabitant of this community.

Dist: Along the rocky shore of Washington and Newport Counties.

Example: Beavertail Point, Jamestown; Cliffwalk, Newport.

6. Maritime Bluff. A community on exposed clay and glacial till substrates of steep faces (bluffs) along the immediate coast of Block Island and some areas around Narragansett Bay. Generally sparsely vegetated, with the highest diversity of plants occurring in patches of freshwater seepage. Representative plants include common horsetail (*Equisetum arvense*), orach (*Atriplex patula*), poison ivy (*Toxicodendron radicans*) and Virginia creeper (*Parthenocissus quinquefolia*). The clay banks tiger beetle (*Cicindela limbalis*) and nesting bank swallows (*Riparia riparia*) are characteristic animals of this community.

Dist: Largest examples are on Block Island, smaller examples occur along the East Bay / Sakonnet shoreline and Aquidneck Island.

Example: Mohegan Bluffs, Block Island; Sachuest Point NWR, Middletown.

7. Maritime Shrubland. Commonly referred to as “Coastal Shrubland”, this community is a maritime feature limited to dry seaside bluffs, headlands, coasts, and islands exposed to ocean winds and salt spray. It is generally low in species diversity, tending to be dominated by a few species of shrubs and scattered small trees. Characteristic shrubs are northern bayberry (*Morella pensylvanica*; formerly *Myrica pensylvanica*), beach plum (*Prunus maritima*), wild rose (*Rosa virginiana*), and poison ivy (*Toxicodendron radicans*). Slightly inland, where maritime climatic influences are reduced, additional species may include shadbush (*Amelanchier* spp.), arrowwood (*Viburnum dentatum*), eastern red cedar (*Juniperus virginiana*), black cherry (*Prunus serotina*), and highbush blueberry (*Vaccinium corymbosum*). Non-native invasives are often present, such as honeysuckles (*Lonicera* spp.), oriental bittersweet (*Celastrus orbiculatus*), rugosa rose (*Rosa rugosa*), and multiflora rose (*Rosa multiflora*). Canopy height can range from 1 to 3 meters. (On sites where trees become dominant and the canopy is over 3 meters, see Maritime Woodland/Forest.)

Dist: Coastal edge and on Block Island and islands in Narragansett Bay.

Examples: Lewis/Dickens farm, Block Island; Sachuest Point, Middletown; Beavertail Point, Jamestown.

B. Woodlands. Upland community structurally intermediate between forest and open barren. Woodlands exhibit a sparse canopy (25 to 60% cover), or one dominated by stunted trees < 16 ft (5 m) tall. The term “barren” is often applied to woodlands on sterile soils (e.g., pitch pine barrens), or to wooded communities occurring on shallow soils overlying bedrock.

1. Maritime Woodland/ Forest. Community of tall shrubs or small trees from 3 to 6 meters (10 to 20 feet) in areas exposed to occasional salt spray and on-shore winds. Characteristic species are shadbush (*Amelanchier* spp.), black cherry (*Prunus serotina*) and sassafras (*Sassafras albidum*). Other associates are black, scarlet oak and/or white oak (*Quercus velutina*, *Q. coccinea*, *Q. alba*), beech (*Fagus grandifolia*), black gum (*Nyssa sylvatica*) and red cedar (*Juniperus virginiana*). Common shrubs and vines include bayberry (*Morella pensylvanica*), arrow-wood (*Viburnum recognitum*), poison ivy (*Toxicodendron radicans*) and Virginia creeper (*Parthenocissus quinquefolia*). The understory may be open or reflect the composition of the Maritime Shrubland Community, the two communities often intergrading and difficult to distinguish. More inventory of this type is needed. Both communities provide an abundance of fruit that is a critical food source for coastal resident and migratory songbirds.

Dist: Block Island and bordering Long Island Sound and lower Narragansett Bay.

Examples: Trustom Pond NWR, Charlestown; Rodmans Hollow, Block Island.

Note: Young examples of this type may be dominated more by early successional species such as sassafras and red cedar and overall composition may be dramatically skewed by past land use. For example, a Beech - Black Gum Forest variant occurs locally, but is an artifact of past clear-cutting and subsequent elimination of typical overstory species such as oak and hickory.

2. Pitch Pine / Scrub Oak Barrens. Woodland community typically found on well-drained sandy soils of outwash plains. Pitch pine (*Pinus rigida*) is the dominant tree varying from 25 to 60% cover, and the shrub layer is dominated by scrub oaks (*Quercus ilicifolia* and *Q. prinoides*), often forming dense thickets. The low shrub canopy typically includes sweetfern (*Comptonia peregrina*), late lowbush blueberry (*Vaccinium angustifolium*), and black huckleberry (*Gaylussacia baccata*). Sandy openings within the woodland may be sparsely vegetated with lichens and mosses, and may also include patches of bearberry (*Arctostaphylos uva-ursi*), heather (*Hudsonia ericoides* and *H. tomentosa*), and wild indigo (*Baptisia tinctoria*). Early sedge (*Carex pensylvanica*) is typically found in the understory, and other herbs present may include goat's-rue (*Tephrosia virginiana*), sickle-leaved golden aster (*Pityopsis falcata*), and wild lupine (*Pityopsis falcata*). Fauna of this community includes Alleghany mound ant (*Formica exsectoides*) and lepidoptera (moths and butterflies) such as buck moth (*Hemileuca maia*), frosted elfin (*Incisalia irus*), and hoary elfin (*Incisalia polios*) that are dependent on specific food plants that occur in this habitat (e.g., scrub oak, wild lupine, wild indigo). This community is typically maintained by periodic wildfire which reduces competing woody species and stimulates (but is not required for) reproduction of pitch pine.

Dist: Washington and Kent Counties.

Examples: Nicholas Farm, Coventry; Arcadia Management Area, Exeter.

3. Red Cedar Rocky Summit. A community on warm, dry, rocky ridges and summits where vegetation may be patchy within areas of exposed bedrock. Eastern red cedar (*Juniperus virginiana*) is the characteristic tree, with understory vegetation dependent on site conditions.

Sparse shrubs may include scrub oak (*Quercus ilicifolia*) or lowbush blueberries (*Vaccinium angustifolia* and *V. pallidum*). Herbaceous plants include hairgrass (*Deschampsia flexuosa*), oat-grass (*Danthonia spicata*) and early sedge (*Carex pensylvanica*). At inland sites, little blue stem (*Schizachyrium scoparium*), ebony spleenwort (*Asplenium platyneuron*), and a sedge (*Carex eburnea*) are common. This community is generally widespread in R.I. but occurs as very small patches.

Dist: Throughout Rhode Island.

Examples: Diamond Hill and Miller's Oak, Cumberland.

C. Forested Uplands. Upland communities with more than 60% canopy cover of trees, occurring on substrates with less than 50% rock outcrop or shallow soil over bedrock. Hardwood types are listed first, followed by coniferous and mixed forests.

1. Oak / Heath Forest. Deciduous forest on well-drained, acidic soils. Black oak and/or scarlet oak (*Quercus velutina*, *Q. coccinea*) are generally dominant, but in less common instances chestnut oak (*Q. prinus*) or white oak (*Q. alba*) are the dominant trees. Common associates include white oak (*Quercus alba*), black birch (*Betula lenta*), black gum (*Nyssa sylvatica*), red maple (*Acer rubrum*) and sassafras (*Sassafras albidum*). Pitch pine (*Pinus rigida*) and white pine (*Pinus strobus*) may be present in small amounts. American chestnut (*Castanea dentata*) was a common associate prior to the chestnut blight; saplings are still found in the understory. Total percent canopy cover can range from 60 to 100% (woodland to forest). The shrub layer is ericaceous with characteristic species including black huckleberry (*Gaylussacia baccata*), mountain laurel (*Kalmia latifolia*), and lowbush blueberries (*Vaccinium pallidum* and *V. angustifolium*). Plants in the ground layer include early sedge (*Carex pensylvanica*), wild sarsaparilla (*Aralia nudicaulis*), and wintergreen (*Gaultheria procumbens*). Three types are recognized based on the dominant oak species.

Dist: Statewide, but most abundant in southern half of state.

Examples: Weetamoo Woods, Tiverton; Francis Carter Preserve, Charlestown; Arcadia Management Area, West Greenwich and Exeter.

a. Black Oak - Scarlet Oak / Heath Forest. This is the dominant type of oak / heath forest in the state, covering large areas intermixed with smaller patches of other forest types. This type fits the main description above with black and/or scarlet oaks being the dominant tree species and heath shrubs characterizing the understory. See below for forest dominated by chestnut oak or white oak.

b. Chestnut Oak Forest. A deciduous forest occurring on well-drained upper slopes and ridgetops where the dominant canopy tree is chestnut oak (*Quercus prinus*) with lesser representation by other oaks (*Q. rubra*, *velutina*, and *alba*). Additional trees may include red maple (*Acer rubrum*) and pitch pine (*Pinus rigida*). Examples: Ell/Long Pond and Blue Pond, Hopkinton; North-South Trail north of Route 6 in Foster.

c. White Oak / Mountain Laurel Forest. Dominated by white oak with an understory

of mountain laurel and sparse herbaceous cover. This type is typically found on well-drained coarse or gravelly soils such as on moraine deposits and eskers. Tends to occur in small patches within larger context of oak and oak – pine forests.

2. Oak – Hickory Forest. A deciduous forest community on well-drained soils of ridgetops and slopes. Soils are usually loams/sandy loams and slightly more mesic and nutrient rich than in Oak - Heath Forests. Red oak (*Quercus rubra*) is typically dominant or co-dominant with lower densities of white oak (*Quercus alba*) and hickories (pignut hickory, *Carya glabra*; shagbark hickory, *C. ovata*; and, mockernut hickory, *C. tomentosa*). Occasionally black oak is dominant. Other associated trees include white ash (*Fraxinus americana*), red maple (*Acer rubrum*), tulip tree (*Liriodendron tulipifera*), and white pine (*Pinus strobus*). A tall shrub subcanopy is typically present with saplings of the canopy trees along with witch hazel (*Hamamelis virginiana*) and flowering dogwood (*Cornus florida*), which are fairly good indicators of this community. Maple-leaved viburnum (*Viburnum acerifolium*) is a characteristic shrub and other low shrubs include lowbush blueberries (*Vaccinium pallidum* and *V. angustifolium*), and sheep laurel (*Kalmia angustifolia*). Typical plants in the herb layer are wild sarsaparilla (*Aralia nudicaulis*), wood ferns (*Dryopteris* spp.), and early sedge (*Carex pensylvanica*). The herb layer is usually more diverse than in the Oak – Heath Forest. The American chestnut (*Castanea dentata*) was formerly a co-dominant canopy tree species in this community prior to the infestation of chestnut blight; today chestnut sprouts remain common in the understory.

Dist: Throughout state; more prevalent farther from the coast.

Examples: Sprague Farm, Gloucester; Canonchet Trail, Hopkinton; Lincoln Woods State Park, Lincoln.

Variant: Rich Oak – Hickory Forest. Occurs on soils overlaying calcareous bedrock such as limestone. The herbaceous layer reflects the calcareous influence and is more diverse than the typical Oak – Hickory Forest. It is characterized by “rich soil indicators” such as ebony spleenwort (*Asplenium platyneuron*), maidenhair fern (*Adiantum pedatum*), bloodroot (*Sanguinaria canadensis*), dogtooth violet (*Erythronium americanum*), and red trillium (*Trillium erectum*). Flowering dogwood and shagbark hickory are more frequent in this association than in the typical Oak – Hickory type as well.

Dist: Uncommon and local in northern part of state

Examples: Limerock Preserve and Lincoln Woods, Lincoln.

3. Oak – Holly Forest. This is an oak-dominated forest with a prominent sub-canopy of American holly (*Ilex opaca*). It occurs on moist, moderately well-drained silt and sandy loam soils, often at the upper edge of forested wetlands (e.g. red maple swamps or red maple – ash floodplain forests). Upslope it often grades into Oak – Heath Forest. Black oak (*Quercus velutina*) and/or scarlet oak (*Quercus coccinea*) are typically dominant, but red maple (*Acer rubrum*) can be prevalent. Frequent associates are white oak (*Quercus alba*), beech (*Fagus grandifolia*), serviceberry (*Amelanchier* sp.) and ironwood (*Carpinus caroliniana*). The understory includes highbush blueberry (*Vaccinium corymbosum*), sweet

pepperbush (*Clethra alnifolia*), New York fern (*Thelypteris noveboracensis*), cinnamon fern (*Osmunda cinnamomea*), greenbriars (*Smilax* spp.), and wild grape (*Vitis* spp.). Holly may be present at low percents in other oak forest types, but here is > 25% cover.

Dist: Predominantly near the coast, but occurs locally inland.

Examples: Wilbur Woods, Little Compton; Pardon Gray Preserve, Tiverton; Great Swamp Management Area, South Kingstown.

4. Mesic Beech – Maple – Red Oak Forest. A hardwood forest on generally moist, well-drained acid soils, broadly defined with several regional and edaphic variants. The canopy is co-dominated by American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*) and/or red oak (*Quercus rubra*). Common associates are white ash (*Fraxinus americana*), yellow birch (*Betula alleghaniensis*), hop hornbeam (*Ostrya virginiana*), red maple (*Acer rubrum*), basswood (*Tilia americana*), and American elm (*Ulmus americana*). White pine (*Pinus strobus*) and hemlock (*Tsuga canadensis*) are occasional. Represented in the tall shrub layer are ironwood (*Carpinus caroliniana*), witch hazel (*Hamamelis virginiana*), and occasionally flowering dogwood (*Cornus florida*). In the northern part of the state, striped maple (*Acer pensylvanicum*) and hobblebush (*Viburnum lantanoides*) occur in the tall shrub layer. The ground layer is generally high in species diversity with characteristic plants including Christmas fern (*Polystichium acrosticoides*), jack-in-the-pulpit (*Arisaema triphyllum*), white baneberry (*Actaea pachypoda*), and false Solomon's seal (*Smilacina racemosa*), with rarer representatives being blue cohosh (*Caulophyllum thalictroides*), wild leek (*Allium tricoccum*), and bloodroot (*Sanguinaria canadensis*). Many herbaceous plants are spring ephemerals that flower before the canopy trees leaf out. (Includes types also known as "Northern Hardwood Forest" and "Red Oak – Northern Hardwood Forest").

Dist: mostly in northern and western part of state.

Examples: George Washington Management Area, Gloucester; Tefft Hill and Stepstone Falls in Arcadia Management Area, Exeter.

5. High Terrace Riverside Forest. Forest communities on upper slopes and terraces of rivers and streams that are flooded only during peak high water events and for short durations. Soils are well-drained and the community is typically mapped as an upland type. Characterized by tree species typical of upland mesic forests, including American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), red oak (*Quercus rubra*), basswood (*Tilia americana*), and ironwood (*Carpinus caroliniana*), and with ferns, spring ephemerals, and other herbaceous plants characteristic of floodplains. A rare community in Rhode Island that was historically more prevalent along the Blackstone River, but creation of dams and alteration of the hydrological regime severely altered the frequency of flooding of these reaches.

Dist: Ravines on Blackstone and Pawcatuck River systems.

Examples: Blackstone River, Cumberland; Stepstone Falls, Arcadia Management Area, Exeter.

6. Pitch Pine - Oak Forest. A mixed coniferous/deciduous forest community that typically

occurs on well-drained, sandy soils of glacial outwash plains and moraines, and also on thin, rocky soils of ridgetops. Dominant trees are pitch pine (*Pinus rigida*), comprising over 25% cover, mixed with one or more oaks including scarlet oak (*Quercus coccinea*), white oak (*Q. alba*), and black oak (*Q. velutina*). The relative proportions of oak and pine are highly variable within this type. The shrub layer is well-developed with scrub oak (*Quercus ilicifolia*), late lowbush blueberry (*Vaccinium angustifolium*), and black huckleberry (*Gaylussacia baccata*), and the herb layer is generally sparse, with bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), early sedge (*Carex pensylvanica*), and pink lady's-slipper (*Cypripedium acaule*). This community is common in R.I. and often develops in the absence of fire as a transition type between pitch pine/scrub oak barren and forest types dominated by oaks. Where white pine is a significant co-dominant, also see White Pine – Oak Forest.

Dist: Providence, Kent, and Washington Counties.

Examples: Kingston Pine Barrens, South Kingstown and Wickaboxet State Forest, West Greenwich.

7. White Pine – Oak Forest. A mixed coniferous/deciduous forest on sandy soils or on slopes with rocky well-drained soils. The canopy is co-dominated by a variable mixture of oaks and white pine (*Pinus strobus*). Oaks include one or more of the following: black (*Quercus velutina*), chestnut (*Q. prinus*), red (*Q. rubra*), white (*Q. alba*), and scarlet (*Q. coccinea*). Pitch pine (*P. rigida*) may be frequent, but usually at lower percent cover. Other common associate trees include red maple (*Acer rubrum*), hemlock (*Tsuga canadensis*), American beech (*Fagus grandifolia*), and black cherry (*Prunus serotina*). The shrub layer is predominantly ericaceous with blueberries (*Vaccinium* spp.), and black huckleberry (*Gaylussacia baccata*). The ground layer is generally sparse and low in species diversity, with species including bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), early sedge (*Carex pensylvanica*), and pink lady's-slipper (*Cypripedium acaule*). Disturbance such as fire, insect and disease outbreaks, and windstorms can allow white pine to seed in or remain dominant for years; otherwise oaks eventually make their way into the canopy and the forest may transition to Oak / Heath Forest or Oak – Hickory Forest.

Dist: Throughout Rhode Island.

Example: George Wasington Management Area, Glocester; Arcadia Management Area, Exeter.

Variant: White Pine Forest – in areas that have been cleared (e.g., old pastures) or were subject to fire or severe canopy die-off from pathogens, white pine may seed in heavily and become the dominant tree. Eventually, oaks may become established and shift the composition towards the mixed forest type. (This differs from the White Pine Plantation, considered a cultivated or managed type that is usually easy to identify by even spacing and arrangement of the trees).

8. Hemlock – Hardwood Forest. A mixed coniferous/deciduous forest that typically occurs on middle to lower slopes of ravines, on cool mid-elevation slopes, and moist uplands on the

edge of swamps. Hemlock (*Tsuga canadensis*) is a co-dominant in the canopy with the following: American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), yellow birch (*Betula alleghaniensis*), black birch (*B. lenta*), and red oak (*Quercus rubra*). Tuliptree (*Liriodendron tulipifera*) may also be present. The relative cover of hemlock is highly variable, ranging from nearly pure stands to as little as 20% of the canopy. In closed canopy stands the shrub and herb layers are sparsely vegetated. Characteristic plants in the understory include cucumber root (*Medeola virginiana*), Canada mayflower (*Maianthemum canadense*), shining clubmoss (*Lycopodium lucidulum*), starflower (*Trientalis borealis*), bellwort (*Uvularia sessilifolia*), common wood-sorrel (*Oxalis acetosella*), partridgeberry (*Mitchella repens*), and painted trillium (*Trillium undulatum*). Some examples of this community have been severely impacted by hemlock woolly adelgid (*Adelges tsugae*), a non-native insect pest, that weakens or kills hemlocks.

Dist: Throughout Rhode Island.

Example: Durfee Hill Management Area, Glocester; Beach Pond, Exeter.

HAPPY TRAILS!

NOTES